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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 30 June 2000 with an application for Letters Patent number 505513 made by MARC DAWSON.

Dated 13 June 2001.

Neville Harris
Commissioner of Patents

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PATENTS ACT 1953

PROVISIONAL SPECIFICATION

IMPROVEMENTS IN AND RELATING TO METHOD AND APPARATUS FOR PRODUCING ANAGLYPHIC 3-D IMAGES

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do hereby declare this invention to be described in the following statement:

IMPROVEMENTS IN AND RELATING TO METHOD AND APPARATUS FOR PRODUCING ANAGLYPHIC 3-D IMAGES

TECHNICAL FIELD

This invention is directed to improvements in and relating to methods and apparata for producing anaglyphic 3-D images.

In particular, the invention is directed to the generation of quality 3-dimensional, stable, coloured images having improved bright register with dynamic and balanced contrast (of anaglyphically viewed stereoscopic images). The method may be used in the production of images required across a range of fields of technology including medicine, and for thermographic, radio sonar and radar imagery applications.

However, as can be appreciated, the invention may have applications outside the fields discussed herein.

BACKGROUND ART

Over recent years consumer preferences have driven development of technology to provide a viewer with good quality images. Display technology allowing only 2-dimensional images to be displayed (with no perception of depth to the viewer) has been widely developed, but provides an image that may appear flat and lifeless.

Production of images in 3-dimensional form has historical origins, beginning to some extent with the invention of the stereoscope. The use of red and blue 3-D glasses serving as colour filters to separate left and right images were popularised in the mid 1950's with 3-D movies.

Modern computer technology has seen greater emphasis placed on the reproduction and storage of 3-dimensional information in order to present images to viewers that

have the perception of depth as opposed to a flat and uninteresting 2-dimensional representation.

Magnetic resonance imaging (MRI) is a form of imaging technology enabling a number of 2-dimensional images to be obtained and from which 3-dimensional models may be constructed. However, such systems often require a huge amount of data processing, a high degree of technical expertise to create the 3-dimensional images/models, significant computer time and purpose built machines to achieve the required end result.

Many systems and methods for displaying three dimensional images from a single two dimensional display surface have been developed over the last century. Commonly this involves use of coloured lenses in front of a viewer's eyes. Typical systems employ:

a) Anaglyphic gels for still or moving image as print, TV or projection,

b) pulfrich lenses for moving image as in TV or projection,

c) polarised lenses typically for projected still or moving image,

d) electro-optic shutters typically for TV display of moving image,

Autostereoscopic or unaided 3-D viewing typically involves use of lenticular arrays and is commonly used to display printed images.

When providing a perception of 3-dimensional images to a viewer, most of the technology has involved placing coloured or polarised lenses in front of an observer's eyes. The images displayed typically consist of two separate, similar images i.e. a stereo pair, superimposed one upon the other, with each image being either coloured so as to be visible through only one of the coloured lenses, or being polarised in the same direction as one of the polarised lenses. The 3-dimensional depth effect arises due to

each eye seeing only one of the images as the other is obscured by the relevant lens. The view visible to each eye is a representation of the views available for each eye from the original scene.

Conventionally, in relation to anaglyphic 3-D images, anaglyphs have involved viewing 3D images via coloured gels. Typically red for the left view, blue for the right. The red gel canceling any red in the anaglyph causing it to dissolve into the white of the page while revealing any blue colours. The blue gel cancels blue while revealing red. This results in a monochromatic image often referred to as black and white. Colour anaglyphs are possible but there have been difficulties experienced as a result of retinal rivalry of brightness and hue contrast and ghosting of bright colours and white.

Anaglyphic viewing causes a spectral split as the colour gels are necessarily from opposite ends of the spectrum (typically across a range of diametrically opposite colours of the spectrum).

United States patent No. 5,491,646 achieves an RGB (Red, Green, Blue) split of red left and blue/green right with green being minimized. However, contrast balance, spectral split, and double imaging of bright colours and white are not addressed.

As can be appreciated from the above description of the prior art and the obvious deficiencies the prior art presents in relation to producing 3-D images, and particularly producing anaglyphic 3-D images. Anaglyphic 3-D viewing though long established has the benefit of being usable across mutli-media format and involves low cost viewing gel or glass lens. This invention aims to address limitations in quality of the anaglyphic image by enabling improved bright register and contrast balance of the image, improved extinction of the opposite eyes view and improved colour perception via easy and convenient computer processing. It would therefore be advantageous to be able to produce anaglyphic 3-D images:

a) easily and conveniently via computer program for example, for a display in RGB format as print, projected image, LCD display or cathode ray tube and so forth; and

b) where such images may be fabricated either in drawings or diagrams, or may be real as in photography, still or moving, and may be re-produced from a recording medium and displayed or broadcast live; and

c) where there was an improved bright register, with dynamic and balanced contrast of the anaglyphically viewed stereoscopic image, thus eliminating retinal rivalry; and

d) that enabled a stable image to be perceived as colour or black and white, and 3-dimensional when viewed through red/blue anaglyphic gels, by enabling near total extinction of the opposite eye's view, and

e) included bright colours or white areas; and

f) was able to eliminate the left/right spectral split associated with anaglyphs; and

g) was able to eliminate strobe effect associated with electro-optics by enabling each eye to have a continuous view of equal brightness; and

h) was able to utilise all existing image display modes.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

STATEMENTS OF INVENTION

According to one aspect of the present invention there is provided a method for

producing anaglyphic 3-D images, said method involving the steps of:

a) using computer programming or analogue treatment of video signal; and

b) isolate, align and/or synchronise stereo pairs; and

c) via a computer filter, adjust colour hues so as to effect an anaglyphic contrast balance of the stereo pairs; and also

d) compress the luminosity of the images; and

e) effecting a colour wash of the images as approximately spectrally opposite hues; and

f) using a computer program to superimpose, blend and fuse the stereo pairs to effect images that are equally represented in the composite; and then

g) expand the contrast of the composite to reveal a 3-dimensional image when viewed anaglyphically, and

said method characterised by the production of an image when viewed through anaglyphic red/blue gels having contrast balance, and in which the problem of double imaging of bright colours and white has been addressed.

In accordance with a further aspect of the present invention there is provided a method substantially as described above wherein the 3-dimensional image created is characterised by being any one of, bright, dynamic in contrast, and dynamic in colour when viewed anaglyphically.

According to another aspect of the present invention there is provided a method substantially as described above wherein the method enables improved brighter register with dynamic and balanced contrasts of the stereoscopic image, thus eliminating retinal rivalry.

According to a further aspect of the present invention there is provided a method substantially as described above wherein the method enables near total extinction of the opposite eye's view including lightly shaded or white areas, and enables a stable image to be perceived as a full colour and 3-dimensional image when viewed through red/blue anaglyphic gels.

According to a further aspect of the present invention there is provided a method substantially as described above wherein the red viewing gel allows perception of the dark end of the spectrum by revealing bluer hues and allows perception of the bright end of the spectrum by revealing redder hues.

According to a further aspect of the present invention there is provided a method substantially as described above wherein the blue gel allows perception of dark and light hues by the same mechanism as above, but contrary in manner.

According to another aspect of the present invention there is provided a method substantially as described above wherein for 3-dimensional motion picture viewing, strobe effect and spectral split are substantially eliminated.

According to a further aspect of the present invention there is provided apparatus to effect the method of producing the anaglyphic 3-D images as described above, said apparatus including a computer program capable of displaying in RGB format as print, projected image, LCD display or a cathode ray tube; and red/blue anaglyphic gels to view the image effected via the method as a colour and 3-dimensional image when viewed through said anaglyphic gels.

According to another aspect of the present invention there is provided apparatus for producing anaglyphic 3-dimensional images, said apparatus including:

a) recording devices capable of recording the image of a preferred subject; and

b) scanning apparatus capable of scanning the recorded image into format capable

of being manipulated via a computer; and

c) associated computer and operation program for manipulating the image as required in accordance with the method as described above; and

d) anaglyphic viewing gels to enable stereo-scopic viewing of the 3-D image created.

According to another aspect of the present invention there is provided apparatus to effect the method of producing the anaglyphic 3-D images substantially as described above wherein in relation to 3-D images for motion picture viewing, the apparatus also includes VSPI switching circuitry.

According to another aspect of the present invention there is provided apparatus for producing anaglyphic 3 dimensional images substantially as described above wherein the 3 dimensional images are monochromatic and appear as if black and white if desired.

According to another aspect of the present invention there is provided apparatus for producing anaglyphic 3-dimensional images substantially as described above wherein the apparata also preferably includes at least one of printing medium, RGB phosphor or LCD screen and video projector, for viewing the 3-dimensional image so created.

For the purpose of this specification, the term computer shall mean and include any computing device including processing means and a memory whether in a desktop, laptop or handheld format including a digital camera, still or motion, and can include a network of computers. It should be appreciated that the hardware may be an off-the-shelf version, or may comprise a purpose-built system.

For the purpose of this specification a program shall mean and include a sequence of instructions able to be executed by a computer, and including a program within other programs, even where the program is limited to the number of instructions provided by

it, and shall include the application of those instructions typically within a sequence of steps leading to a desired result and where a sequence of steps may require physical manipulation of physical or mathematical quantities, signals or information. It should be appreciated that the program may be an off-the-shelf software version, or may comprise a purpose-built system. This may be described in computer terminology and/or other physical or mathematical terminology (such as bits, pixels, values, elements, symbols, characters, terms, numbers and so forth).

For the purpose of this specification, the term anaglyph is any 2-dimensional image that is given the appearance of being a 3-dimensional image when viewed through anaglyphic gels. Such gels or lenses typically comprise approximately diametrically opposite colours of the colour wheel/colour spectrum.

The method of the present invention involves the production of anaglyphic 3-D images via computer program or analogue video signal control for display in RGB format as print, projected image, LCD display or on cathode ray tube. Such images may be fabricated as in drawings or diagrams or may be real as in photography, still or moving and may be reproduced from a recording medium and displayed or broadcast live.

As can be appreciated, three colours of light can be mixed together to produce any other colour. These are red, green and blue. Coloured images are often stored as a sequence of RGB triplets, or a separate red, green and blue overlays, although this is not the only possible representation. These colours correspond to the three "guns" in a colour cathode ray tube and to the colour receptors in the human eye. An image in RGB format is typically a coloured image, as opposed to a monochrome (black and white) image.

The process of the present invention preferably enables the production of a 3 dimensional image having improved bright register with dynamic and balanced

contrast of the resultant anaglyphically viewed stereoscopic image, thus eliminating retinal rivalry.

This process also preferably enables near total extinction of the opposite eyes view including bright colours or white areas and enables a stable image to be perceived as colour and as three-dimensional when viewed through red/blue anaglyphic gels. In some embodiments, the invention may be applied using anaglyphic gels of various spectral colours/frequencies where the colours are approximately diametrically opposite pairs (to each other) on the colour wheel.

A preferred embodiment of this invention substantially eliminates the left/right spectral split associated with anaglyphs by viewing rapid alternation of oppositely orientated anaglyh (Modulating Anaglyph) through synchronously alternating electro-optic anaglyphic filters.

Accordingly, in one application of the present invention in relation to moving pictures, the recognised strobe effects associated with electro-optics are also able to be virtually eliminated as each eye has a continuous view of equal brightness.

In relation to 3-D imaging the phenomenon of retinal rivalry becomes apparent when viewing one's surroundings through red/blue anaglyphic gels. The red gel reveals a monochromatic range of hues from black to a bright red. (which equates with white). The blue gel reveals a broader spectrum biased toward blue including bright blue (which equates to white). When a red object is observed, the red gel reveals it as pale to near white – depending on the actual colour temperature of the object, while the blue gel reveals it as dark to black. When a green or blue object is observed, the red gel reveals it as dark to black while the blue gel reveals it as green/blue to near white – depending on the actual colour temperature of the object.

The rivalry of contrast is evident with anaglyphic monitoring of any single colour.

However, any colour present in corresponding areas of a stereo pair may be contrast balanced for anaglyphic viewing. Anaglyphic contrast balance is a solution to retinal rivalry and enables corresponding area's of the stereo pairs to be perceived as equal in brightness and colour contrast, as in natural viewing.

In accordance with one preferred embodiment of the present invention, anaglyphic contrast balance is achieved by selective colour adjustment via computer filter to alter the colour register of the stereo pairs. For example, to solve rivalry perceived viewing red, which appears light through the red gel and dark through the blue gel, a cyan hue is added to the red colour record of the image to be viewed through the red gel (making reds appear darker) and red is removed from the red colour record of the image to be viewed through the blue gel (making reds appear lighter through the blue gel). An anaglyphic balance of contrast for red is achieved.

To solve rivalry perceived viewing light blue which appears dark through the red gel and light through the blue gel, a cyan hue is removed from the cyan colour record of the image to be viewed through the red gel (making cyan appear lighter) and magenta is added to the cyan colour record of the image to be viewed through the blue gel (making light blues appear darker). An anaglyphic balance of contrast for light blue is achieved.

In other applications of the present invention, anaglyphic contrast balance may also be achieved by removing black from the colour record that appears too dark or by adding black to the colour record that appears too light. However, this process harms the perceivable colour register possible with colour anaglyphs and so anaglyphic contrast balancing is preferable. However, adding or subtracting black can be used to assist with control of brightness.

An anaglyphic contrast balance can also be achieved for other hues between red and blue by isolating and altering their colour records. The balance can be achieved by

many variations of addition and subtraction, but the alterations should tend to reclaim details and tones and hues altered because of viewing through coloured gels. In this way the anaglyphic contrast balance serves four functions:

1. To equalise contrasts of brightness between corresponding areas of the stereo pairs, and

2. To cause detail and tone to be evenly and faithfully presented to each eye as in natural viewing, and

3. To compensate for viewing through coloured gels; and

4. Assists in assigning bright colour records into separate left and right channels within the limits of later treatments of luminosity compression and colour wash.

For white, in either the left or right image, black is preferably added. For black, in either image, black is preferably removed to lessen its saturation. This assists in reducing contrast (compared with the final stage that involves increasing contrast) and enabling uptake of the colour wash, soon to follow as described further below.

The Anaglyphic Contrast Balance may be preferably preset to render all adjustments with a single sweep or in other applications it may be preferable to treat colour groups individually.

The present invention of the present application is also directed to improved extinction of the opposite eyes view via improved left/right channel separation. Luminosity compression is a solution for ghosting or the perception of double images especially evident with the light to white areas of the stereoscopic anaglyphic image.

For example, white (present in corresponding areas of the stereo pairs) fails to take up any coloured hues rendered and so is not allocated to a colour channel to enable its exclusive view to the appropriate eye.

Luminosity compression of the stereo pair causes their spectrums from extreme black to white and all contrasts in between (and along with their colour hues) to be compressed. This causes both white and bright colours to "gather" gray that will subsequently take up any red or blue rendered to it thereby enabling allocation to a colour channel. The compression allows the image to take up the colour wash (described below) across the images contrasts and hues.

Luminosity compression can be achieved with a computer filter reducing both brightness and contrast thereby reducing the images output levels.

As the left and right stereo pairs are intended to be exclusively offered to corresponding eyes for viewing through anaglyphic gels, the contrast and colour information in each image must be placed inside spectrally opposing colour channels.

Colour washing (rendering a saturation) of predominantly red across shadow, midrange and highlights of the image to be viewed through the red gel, and colour washing predominantly blue across shadow, midrange and highlights of the image to be viewed through the blue gel enables placement inside approximately spectrally opposite colour channels. Although seeming to appear obliterated, the contrast and colour information remain retrievably intact.

The image to be viewed through the red gel therefore appears a blown out bright red when viewed through the red gel and virtually black when viewed through the blue gel.

The image to be viewed through the blue gel therefore appears a blown out bright blue when viewed through the blue gel and virtually black when viewed through the red gel.

This demonstrates:

1. Near total extinction of the opposite eyes view.

2. That each eye's opposing view will be perceived invisibly as black; and

3. That the image colour washed "red" will be viewed by the red gel, and the "blue" by the blue gel.

The Anaglyphic Contrast Balance, Luminosity Compression and Colour Wash may be preset to render all adjustments with a single sweep for each of the pair enabling easy and convenient anaglyph production, or separate custom settings may be rendered individually.

With superimposition and blending and fusion, the two images, left and right, now become one.

For those unfamiliar with the art as the two images are a stereo pair, they are necessarily identical in size and have been set to appear as a stereoscopic image within the boundaries of the viewing window or edges of the images when stereoscopically viewed.

With one of the images of the stereo pair superimposed over the other (for example red on top of blue) they can be blended so that they appear equally prominent. This can be achieved using a computer program by causing the image on top to become 50% opaque so that 50% of the image below also shows. The separate red and blue images of the stereo pair can then be combined and fused as a single composite image. This is preferably achieved by using a computer program to merge layers.

The next step is preferably to attend to contrast expansion.

An anaglyphic 3D image formed thus far is apparent through anaglyphic gels though it is dim to view. This is because the contrast and colour information inside each colour channel are still in a compressed state. Their expansion enables details of contrast and colour that fall within each colour channel to be regained and also utilise the hue of the opposing view for anaglyphic black.

The expansion is preferably achieved using a computer program to increase the contrast level. This has the effect of shifting the darkest parts of the composite toward the lowest frequencies inside the respective anaglyphic channels, while simultaneously shifting the brightest parts of the composite toward the highest frequencies inside the respective anaglyphic channels. Brightness control of highlights, midrange and shadow levels of red, green and blue can further fine tune the expansion.

This process reveals a bright anaglyphic 3-D image with near total extinction of each opposite view, with a balanced and dynamic contrast perceived in colour when viewed through red/blue anaglyphic gels.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which, though limited to black and white as per regulation for patent application show:

Figure 1 a representation of a stereo pair in accordance with one preferred embodiment of the present invention; and

Figure 2 a representation showing retinal rivalry correction via anaglyphic contrast balance in accordance with one preferred embodiment of the present invention; and

Figure 3 a representation of luminosity compression of the anaglyphically contrast balanced stereo pair in accordance with one preferred embodiment of the present invention; and

Figure 4 a representation of colour wash in accordance with one preferred embodiment of the present invention; and

Figure 5 a representation of contrast expansion in accordance with one preferred embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

With reference to the diagrams and to the following description by way of example only there is provided, a method for producing anaglyphic 3-D images using computer programming. Figure 1a relates to the left view, whilst Figure 1b relates to the right view. The method involves as previously identified:

a) isolating the stereo pair of images, correctly set by aligning and/or synchronising said stereo pairs, whether said stereo pairs are obtained from still or motion pictures, and whether said stereo pairs are in colour or black and white; and

b) via a computer filter or analogue control of video signal, adjusting colour hues so as to effect an anaglyphic contrast balance of the stereo pairs as shown in Figure 2 (where retinal rivalry is illustrated as shown such that a colour hue revealed as bright through red gel is viewed as dark through blue gel in Figure 2a and b respectively), whilst the anaglyphic contrast balance of colour hue is shown in Figures 2c and d. Figures 2a and 2c relate to the red gel view, whilst Figures 2b and 2d relate to the blue gel view; and also

c) compressing the luminosity of the anaglyphically contrast balanced stereo pair 3a and 3b; and

d) effecting a colour wash (as shown in Figure 4) of the images as approximately spectrally opposite hues, where the colour wash is predominantly red to the left image and blue to the right image which are then; and

e) using a computer program to superimpose, blend and fuse the stereo pairs to effect images that are equally represented in the composite; and then

f) expanding the contrast level of the composite (as shown in Figure 5) to reveal a 3-dimensional image when viewed anaglyphically. Contrast expansion reveals a red/left orientated anaglyph. Left and right views are exclusive to each eye with the red gel over the left eye and the blue gel over the right eye. A colour print is required to perceive 3-D images.

Should a monochromatic 3-D image, still or moving be required, de-saturation (i.e. conversion to black and white) of the stereo pairs takes place instead of step b (i.e. instead of the anaglyphic contrast balance.

The image produced when viewed through anaglyphic red/blue gels has contrast balance, and double imaging of bright colours and white is near totally eliminated.

The apparatus for producing anaglyphic 3-dimensional images typically includes:

a) recording devices capable of recording the image of a preferred subject; and

b) scanning apparatus capable of scanning the recorded image into format capable of being manipulated via a computer; and

c) associated computer and operation program for manipulating the image as required in accordance with the methods as described above; and

d) anaglyphic viewing gels to enable stereo-scopic viewing of the 3-D image created; and including

e) electro-optic red/blue transition anaglyphic filter glasses.

Any suitable software may be used or adapted for use to effect the invention.

The following examples are directed to the use of the present invention and to various applications of the invention across a number of fields of technology. It should be appreciated that variations to the invention are also relevant to applications not

necessarily herein described, and the scope of the invention should not be considered to be limited merely by these applications being absent from this description.

EXAMPLE 1

Example of an Anaglyphic Contrast Balance pre-set effect (ACB):

Left/Red image	Right/Blue image
Red + cyan	Red – magenta
Yellow + cyan + black	Yellow + cyan - magenta
Green – cyan	Green + cyan – magenta
Cyan – cyan	Cyan + magenta
Blue – cyan	Blue - magenta
White + black and/or magenta	White + black and/or cyan
Black – black	Black – black

The basic Anaglyphic Contrast Balance addresses the primary colours; Red, Green and Blue.

EXAMPLE 2

The present invention lends itself to a number of applications

1. STROBE FREE AND SPECRAL SPLIT FREE VIEWING VIA RED/BLUE TRANSITION ELECTRO-OPTIC ANAGLYPHIC FILTER GLASSES

Traditional LCD elecro-optic shutter 3D glasses alternate rapidly between clear and dark states so as to present the left and right views (alternating on a television monitor or other screen) exclusively to each eye. This results in each eye being subjected to a

strobe effect alternating between light and dark. When the left eye's shutter is clear, the right eye's shutter is dark and visa versa. The frequency of alternation can match the field rate of 50 per second. This allows 25 views per second for each eye. This degrades the viewing quality by half compared to regular 2D viewing.

It is well known in Electoencephalography (EEG) that strobe effect can induce abnormal electrical discharges. Patients are subjected to a strobe light to elicit potential for epileptic seizure. To subject a viewer to a left/right alternating 25Hz strobe effect therefor has potential for harm.

Two novel features of this invention are that for 3D motion picture viewing, both the strobe effect and spectral split are eliminated.

In the preferred embodiment of this invention for the production of anaglyphic motion pictures, the principles of electro-optic shutters and anaglyphic viewing are combined.

When polarizing interface filters (PIFs) that alternate between red and blue are used as viewing filters, each eye views through both halves of the colour spectrum in alternation so that the left eye sees red then blue while the right eye sees blue then red.

Such electo-optic material is described in US Patents 5,990,996, / 5,999,240 and 5,528,393. Elements are arranged to elicit field speed alternations of saturated and tuneable hues.

Other than a very brief period between each field display (the vertical sync pulse interval. VSPI) there is no strobe effect. The VSPI is present during regular 2D viewing.

2. MODULATED ANAGLYPHIC MOVIE

To produce the anaglyphic movie, two versions are made. One with regular red on the left viewing orientation and the other with blue left orientation. The two are then

interpolated so as to alternate between red left and blue left orientation when the movie plays. This can be achieved using a computer program to interlace the two versions at field or frame rate or any desired rate of modulation. The VSPI between fields triggers the switching of the electro-optic filters to synchronize the red/blue orientation of the filters with the viewing orientation of the anaglyph.

Such VSPI switching and synchronisation is well known and achievable with recognition of field differentiation (thus viewing orientation) and wireless transmission of the VSPI to the electro-optic filters. Such a circuit is described in US Patent No.4,145,713.

The resulting effect is that each eye, simultaneously and without strobing, sees only it's intended view as the viewing filters colour phase alternates it's orientation in sync with the anaglyphically modulating movie.

Persistence of vision causes each eye (viewing both sides of the spectrum in rapid alternation) to perceive both sides of the spectrum as if constant.

The result is a strobe free and spectral split free, bright anaglyphic 3D moving image with near total extinction of the opposing view, with a balanced and dynamic contrast that is perceived in colour when viewed through electro-optic anaglyphic filters.

3. VARIATIONS

The perception of red is dull and this may be assisted by omitting to ACB treat the red colour record of the images to be viewed through red phases of the electro-optic anaglyphic filters. Or, the ACB filter treatment (adding cyan to the red colour record) may be applied to a lesser extent. In this way the colour perception of red to each eye is enhanced.

Other variations of Anaglyphic modulation sequencing and frequency are possible.

The movie may also be processed entirely without the ACB filter. This would present the viewer with subtle alternations of contrasts especially when viewing objects of red, blue or green, but may be preferred as colours would appear more natural than when the ACB filter is used as it necessarily alters the colour record.

4. RGB PRINTED IMAGES

Billboard, poster, product brochure, postcard, advertising, wallpaper, technical or educational diagram.

Fewer colours are available with CMYK mode. Printing in RGB (Red, Green, Blue) produces better results.

5. TELEVISION AND COMPUTER DISPLAY

Possible applications include: Internet presentation, motion picture production, video, CD ROM image files, laser disk images, transfer to cinema film for projection. However, whilst much more computing is required for motion pictures, even live broadcast is possible with preset levels of ACB filter compression/wash and expansion. Processing of the anaglyph may take place in part or whole at the receiving end as a variation.

Display of a still image on a display monitor may be conventional red left with spectral split or alternate with blue left orientation for spectral split free viewing via electro-optic anaglyphic glasses.

6. THE INSTANT ANAGLYPHIC DIGITAL CAMERA – STILL OR MOTION

A twin lens camera exposes two laterally parallaxed views onto a CCD array enabling a stereo pair. The electronic record of this exposure is then given a filtering treatment with internal selectable or auto-adjusting pre-set values of Anaglyphic Contrast Balance, Compression, Colour Wash, Blend and Expansion to reveal a screen monitor

image of a colour anaglyph for print, storage, transfer, etc. Such a camera may both capture the stereo pair and process the anaglyph or just capture the stereo pair for transfer to a computer for processing.

7. THE ANAGLYPHIC PRODUCTION SOFTWARE PACKAGE

Includes:

Programs to prepare the stereo pair; for example, for alignment, rotation, size, cropping, scale, skew, distort, perspective, stereo window setting.

Controls for optimising image quality prior to Anaglyphic Contrast Balance; for example to effect brightness, contrast, colour management, equalisation.

Controls for Anaglyphic Contrast Balance; Colour isolation and mixing, Luminosity Compression, Colour Wash, Layer Blending, Contrast Expansion, Levels adjustment.

Adjustments may be set individually or pre-set levels may render adjustments with a single sweep.

Video program includes 6 layer editing and interlacing control.

8. THERMOGRAPHY

Used commercially and medically, Infrared detectors reveal grades of temperature by displaying representative colours. A peculiar image results with many visual cues of the subject/scene being replaced by colour zones that relate to temperature. An Anaglyphic view obtained from a stereo pair of thermographs by using the process here described, assists in making better sense of coloured zones by revealing depth.

Diagnosis and or measurement may still be accurately made from the colour display of either of the original stereo pair pre-treatment.

3-D Night vision display may also be achieved.

9. RADIOGRAPHY

Using the process of production herein described, an anaglyph may be produced from a stereo pair of x-rays to reveal depth information. An RGB monitor may be used to display instant motion picture x-ray as in fluoroscopy.

10. RADIO SONAR AND RADAR IMAGRY

Visualization of position and relative depth information can be achieved even for extremely distant objects by increasing the distance between the left and right recording points. The further away the object is, the wider the stereo base needs to be to achieve stereopsis. Once captured and rendered by the process here described, anaglyphic imagery can be attained of space, aeronautic, subaquatic and subterranean features.

Any stereo image pair may be digitised and be processed into an anaglyph.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

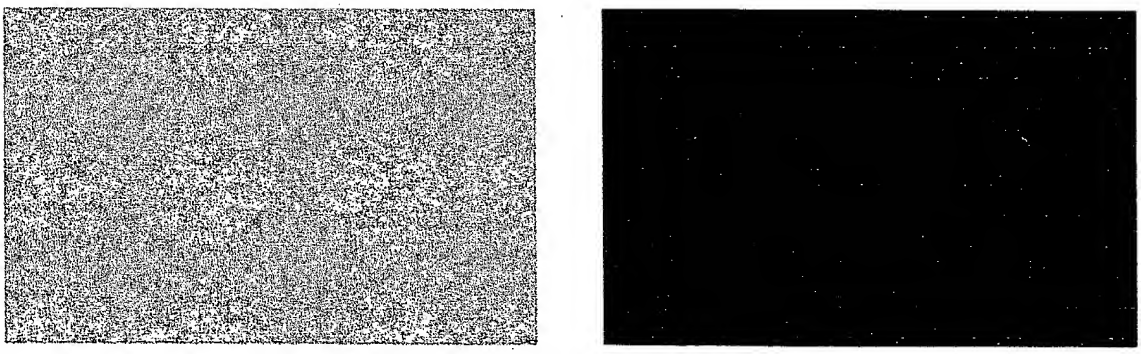
MARC DAWSON

by his Attorneys

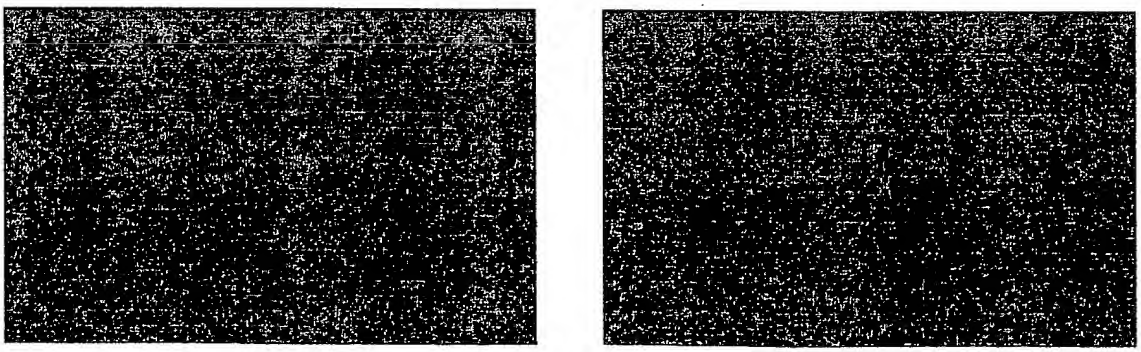
JAMES & WELLS

(a) **Figure 1.** (b)

(a) **Figure 2.** (b)



(c) (d)



(a) Figure 3. (b)

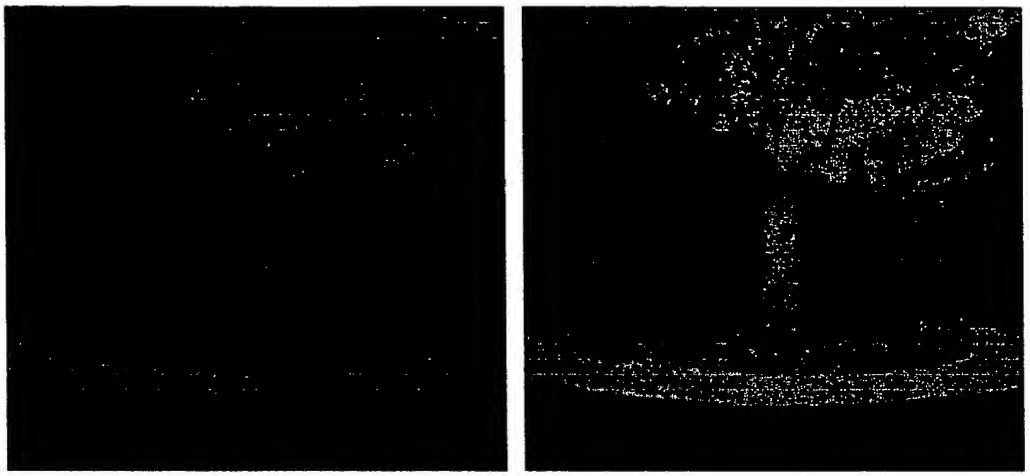


Figure 4.

(a)

(b)

Figure 5.